Remarks

There is no amendment to the claims in this response.

Marked-up Set of Claims (According to 37 CFR 1.173(b)(2))

1. (Ten times amended) A method for dewatering biological sludge [that has been digested by]from a thermophilic digestion process, comprising:

a. adding a polymeric quaternary ammonium compound[s], as primary component, to the biological sludge; and

b. adding [polyacrylamide]to the biological sludge a cationic polyacrylamide or separate from the polymeric quaternary ammonium compound adding an anionic polyacrylamide;

such that [any combinations of] the polymeric quaternary ammonium compound[s] and [of]the polyacrylamide[s] enhance dewatering of the sludge.

2. (Ten times amended) The method for dewatering biological sludge according to claim 1, wherein [the]said polymeric quaternary ammonium compound[s] is[are from] poly(di-allyl di-methyl ammonium chloride) (poly(DADMAC))[family].

3. (Eleven times amended) The method for dewatering biological sludge according to claim 1, wherein [the]said polymeric quaternary ammonium compound[s] is[are from] poly(epichlorohydrin di-methyl amine) (poly(epi-DMA))[family].

4. (Four times amended) The method for dewatering biological sludge according to claim 1, wherein [the]said polymeric quaternary ammonium compound is added directly to the sludge; and

[, upon]following the formation of microflocs of the sludge from addition of the polymeric quaternary ammonium compound, [a]said cationic polyacrylamide is added[to form a floc that dewaters the sludge].

5. (Four times amended) The method for dewatering biological sludge according to claim 4, wherein [the]said polymeric quaternary ammonium compound and [the]said cationic polyacrylamide are in an approximate[ly] 1:1 ratio, with [the]said cationic polyacrylamide having a higher molecular weight than the polymeric quaternary ammonium compound[does].

6. (Four times amended) The method for dewatering biological sludge according to claim 4, wherein the ratio[s] of [the]said polymeric quaternary ammonium compound with respect to [the]said cationic polyacrylamide range from about 1:10 to about 20:1.

7. (Twice amended) The method for dewatering biological sludge according to claim 4, wherein the polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids component of the sludge is between about 50 ppm:1 percent and about 300 ppm:1 percent.

8. (Three times amended) The method for dewatering biological sludge according to claim 1, wherein the polymeric quaternary ammonium compound is added directly to the sludge[, in an amount sufficient to cause formation of a cationic overcharge within a developed microfloc system], and wherein ______ said polyacrylamide is[and an] anionic[polyacrylamide is then added for final floc formation].

9. (Cancelled)

10. (Five times amended) The method for dewatering biological sludge according to claim 8, wherein [the]said polymeric quaternary ammonium compound and [the]said anionic polyacrylamide are in an approximate[ly] 10:1 ratio, with [the]said anionic polyacrylamide having a higher molecular weight than the polymeric quaternary ammonium compound[does].

11. (Amended) The method for dewatering biological sludge according to claim 10, wherein [the]said anionic polyacrylamide is about 40% anionic.

12. (Four times amended) The method for dewatering biological sludge according to claim 8, wherein the ratio[s] of [the]said polymeric quaternary ammonium compound to [the]said anionic polyacrylamide ranges from about 1:10 to about 20:1.

13. (Three times amended) The method for dewatering biological sludge according to claim 8, wherein the polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids component of the sludge is between approximately 50 ppm:1 percent and approximately 300 ppm:1 percent.

14. (Original) The method for dewatering biological sludge according to claim 1, wherein the biological sludge is mixed with primary sludge.

15. (Ten times amended) [A composition]The method for dewatering biological sludge according to claim 1, [comprising] wherein

said polymeric quaternary ammonium compound[s, as primary component, and] is added along with said cationic polyacrylamide[, said components being present in the composition in a ratio to enable the composition to function as an agent for dewatering biological sludge from a thermophilic digestion process].

16. (Nine times amended) The method for dewatering biological sludge according to claim 1, wherein [the]said cationic or anionic polyacrylamide and [the]said polymeric quaternary ammonium compound[s] are [used]added in solution [or in dry] form.

17 – 21. (Canceled)

22. (Four times amended) A method for dewatering sludge comprising water and solids, wherein the solids comprise thermophiles, the method comprising:

contacting the sludge with a polymeric quaternary ammonium compound along with a cationic polyacrylamide; or

contacting the sludge first with a polymeric quaternary ammonium compound and then with a cationic polyacrylamide;

to form a floc.

23. (Cancelled)

24. (Four times amended) The method of claim 22, wherein said polymeric quaternary ammonium compound comprises a molecular weight in the range of about 500,000 to about 3,000,000 and said cationic polyacrylamide comprises a molecular weight in the range of about 5,000,000 to about 16,000,000.

25. (Twice amended) The method of claim 22, wherein said polymeric quaternary ammonium compound is added in an amount sufficient to form microflocs of said thermophiles; and wherein

said cationic polyacrylamide is added in an amount sufficient to agglomerate the microflocs into flocs for dewatering.

26. (Five times amended) The method of claim 22, wherein said polymeric quaternary ammonium compound comprises at least one compound selected from the group consisting of poly(di-allyl di-methyl ammonium chloride) and poly(epichlorohydrin di-methyl amine).

27. (Twice amended) The method of claim 25, wherein the ratio of said polymeric quaternary ammonium compound to said cationic polyacrylamide is in the range of about 1:10 to about 20:1.

28. (Three times amended) The method of claim 25, wherein the concentration of said polymeric quaternary ammonium compound and said cationic polyacrylamide to the percentage of solids in said sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

29 – 32. (Canceled)

33. (Twice amended) A method for dewatering a sludge comprising water and thermophiles, the method comprising:

adding to the sludge a polymeric quaternary ammonium compound.

34. (Canceled)

35. (Three times amended) The method of claim 33, wherein said polymeric quaternary ammonium compound is added in an amount sufficient to form microflocs of the thermophiles.

36. (Five times amended) The method of claim 35, wherein said polymeric quaternary ammonium compound comprises at least one compound selected from the group consisting of poly(di-allyl di-methyl ammonium chloride) and poly(epichlorohydrin di-methyl amine).

37. (Three times amended) The method of claim 35, wherein the concentration of said polymeric quaternary ammonium compound to the percentage of solids in said sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

38. (Five times amended) The method of claim 35, further comprising the addition of an anionic polyacrylamide for final floc formation.

39. (Cancelled)

40. (Three times amended) The method of claim 38, wherein the concentration of said polymeric quaternary ammonium compound to the percentage of solids in said sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

41. (Three times amended) A sludge composition comprising:

water;

polyacrylamide comprising a cationic or an anionic moiety;

a polymeric quaternary ammonium compound; and

solids comprising thermophiles.

42 – 43. (Cancelled)

44. (Five times amended) The sludge composition of claim 41, wherein said polymeric quaternary ammonium compound comprises at least one compound selected from the group consisting of poly(di-allyl di-methyl ammonium chloride) and poly(epichlorohydrin di-methyl amine).

45. (Three times amended) The sludge composition of claim 41, wherein the ratio of said polymeric quaternary ammonium compound to said polyacrylamide is in the range of about 1:10 to about 20:1.

46. (Three times amended) The sludge composition of claim 41, wherein the concentration of said polymeric quaternary ammonium compound and said polyacrylamide to the percentage of solids in said sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

47. (Five times amended) The sludge composition of claim 41, wherein said polymeric quaternary ammonium compound comprises a molecular weight in the range of about 500,000 to about 3,000,000; wherein

said polyacrylamide comprises a cationic moiety having a molecular weight in the range of about 5,000,000 to about 16,000,000; or wherein

said polyacrylamide comprises an anionic moiety having a molecular weight in the range of about 5,000,000 to about 15,000,000.

48. (Four times amended) A sludge composition comprising:

water;

polyacrylamide comprising a cationic or an anionic moiety;

a polymeric quaternary ammonium compound; and

solids comprising flocs of thermophiles.

49 – 50. (Cancelled)

51. (Five times amended) The sludge composition of claim 48, wherein said polymeric quaternary ammonium compound comprises at least one compound selected from the

group consisting of poly(di-allyl di-methyl ammonium chloride) and poly(epichlorohydrin di-methyl amine).

52. (Three times amended) The sludge composition of claim 48, wherein the ratio of said polymeric quaternary ammonium compound to said polyacrylamide is in the range of about 1:10 to about 20:1.

53. (Three times amended) The sludge composition of claim 48, wherein the concentration of said polymeric quaternary ammonium compound and said polyacrylamide to the percentage of solids in said sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

54. (Five times amended) The sludge composition of claim 48, wherein said polymeric quaternary ammonium compound comprises a molecular weight in the range of about 500,000 to about 3,000,000, wherein

said polyacrylamide comprises a cationic moiety having a molecular weight in the range of about 5,000,000 to about 16,000,000; or wherein

said polyacrylamide comprises an anionic moiety having a molecular weight in the range of about 5,000,000 to about 15,000,000.

55. (Four times amended) A sludge composition comprising:

water;

a polymeric quaternary ammonium compound; and

solids comprising thermophiles.

56 – 57. (Cancelled)

58. (Five times amended) The sludge composition of claim 55, wherein said polymeric quaternary ammonium compound comprises at least one compound selected from the group consisting of poly(di-allyl di-methyl ammonium chloride) and poly(epichlorohydrin di-methyl amine).

59 – 66. (Cancelled)

67. (Amended) <u>A sludge composition comprising:</u>

<u>water;</u>

<u>thermophiles; and</u>

<u>a polymeric quaternary ammonium compound.</u>

68. (Five times amended) <u>The sludge composition of claim 67, wherein said polymeric quaternary ammonium compound comprises at least one compound selected from the group consisting of poly(di-allyl di-methyl ammonium chloride) and poly(epichlorohydrin di-methyl amine).</u>

69. (Twice amended) <u>The sludge composition of claim 67, wherein said polymeric quaternary ammonium compound is present in an amount sufficient to form microflocs of said thermophiles.</u>

70. (Three times amended) <u>The sludge composition of claim 67, further comprising a cationic or an anionic polyacrylamide.</u>

71 – 72. (Canceled)

73. (Amended) <u>The method of claim 33, wherein a cationic polyacrylamide is added.</u>

74 – 79. (Canceled)

Claim List – Status and Support of Current Amendment Changes

Claim	Status	Type	Support of Changes
1	Pending	Method	There are no changes in this response.
2	Pending	Method	There are no changes in this response.
3	Pending	Method	There are no changes in this response.
4	Pending	Method	There are no changes in this response.
5	Pending	Method	There are no changes in this response.
6	Pending	Method	There are no changes in this response.
7	Pending	Method	There are no changes in this response.
8	Pending	Method	There are no changes in this response.
9	Cancelled	N/A	N/A
10	Pending	Method	There are no changes in this response.
11	Original	Method	There are no changes in this response.
12	Pending	Method	There are no changes in this response.
13	Pending	Method	There are no changes in this response.
14	Pending	Method	There are no changes in this response.
15	Pending	Method	There are no changes in this response.
16	Pending	Method	There are no changes in this response.
17-21	Cancelled	N/A	N/A
22	Pending	Method	There are no changes in this response.
23	Cancelled	N/A	N/A
24	Pending	Method	There are no changes in this response.
25	Pending	Method	There are no changes in this response.
26	Pending	Method	There are no changes in this response.
27	Pending	Method	There are no changes in this response.
28	Pending	Method	There are no changes in this response.
29-32	Canceled	N/A	N/A
33	Pending	Method	There are no changes in this response.
34	Cancelled	N/A	N/A
35	Pending	Method	There are no changes in this response.
36	Pending	Method	There are no changes in this response.
37	Pending	Method	There are no changes in this response.
38	Pending	Method	There are no changes in this response.
39	Cancelled	N/A	N/A
40	Pending	Method	There are no changes in this response.
41	Pending	Composition	There are no changes in this response.
42-43	Cancelled	N/A	N/A
44	Pending	Composition	There are no changes in this response.
45	Pending	Composition	There are no changes in this response.
46	Pending	Composition	There are no changes in this response.
47	Pending	Composition	There are no changes in this response.
48	Pending	Composition	There are no changes in this response.
49-50	Cancelled	N/A	N/A

51	Pending	Composition	There are no changes in this response.
52	Pending	Composition	There are no changes in this response.
53	Pending	Composition	There are no changes in this response.
54	Pending	Composition	There are no changes in this response.
55	Pending	Composition	There are no changes in this response.
56	Cancelled	N/A	N/A
57	Cancelled	N/A	N/A
58	Pending	Composition	There are no changes in this response.
59-66	Cancelled	N/A	N/A
67	Pending	Composition	There are no changes in this response.
68	Pending	Composition	There are no changes in this response.
69	Pending	Composition	There are no changes in this response.
70	Pending	Composition	There are no changes in this response.
71-72	Canceled	N/A	N/A
73	Pending	Method	There are no changes in this response.
74-79	Canceled	Method	N/A

Applicant's Responses to the Examiner's Rejections, Arguments and Objections

Examiner Rejection

Claims 1, 2, 3, 8, 10 – 13, 33, 35 – 38, 40 – 41, 44 – 48, 51 – 55, 58, 67 – 70 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohara in view of USP 5,112,500 to Jones.

Applicant's Response

Applicant appreciates effort of the Examiner to formulate his rejection.

Applicant argument compares Ohara and Jones to the instant independent claims; wherein, instant independent claim 1 forms the basis of Applicant's argument:

> 1. A method for dewatering biological sludge from a thermophilic digestion process, comprising:
>
> a. adding a polymeric quaternary ammonium compound, as primary component, to the biological sludge; and
>
> b. adding to the biological sludge a cationic polyacrylamide or separate from the polymeric quaternary ammonium compound adding an anionic polyacrylamide;
>
> such that the polymeric quaternary ammonium compound and the polyacrylamide enhance dewatering of the sludge.

In the Ohara argument, the Examiner first refers to Ohara, p. 917 at middle of left column, Fig. 5 and Table III. Applicant has reviewed Ohara, p. 917, finding: 1) Ohara teaches "An interesting outcome of this study was the significantly better dewatering characteristics of thermophilic, as compared to mesophilic sludge" (Ohara p. 917, bottom of left column), which significantly conflicts with the instant invention teaching and claims; 2) there is no teaching or suggestion of the instant independent claims; as, there is no teaching or suggestion in Ohara for use of a polyquaternary ammonium compound with a cationic or an anionic polyacrylamide; while, 3) Table III only compares dewatering with and dewatering without a polymer; wherein again, there is no teaching or suggestion of the instant independent claims; as, there is no teaching or suggestion for use of a polyquaternary ammonium compound with a cationic or an anionic polyacrylamide.

Second, the Examiner refers to Ohara, p. 914 right column. Applicant has reviewed Ohara, p. 914 right column, finding Ohara to teach "In the coagulation study ferric chloride, lime, alum, and 41 polymers were evaluated. Tests indicated that polymers, in general, were more effective for coagulation than the inorganic coagulants, and that a combination of anionic and cationic polymers worked best" (Ohara, p. 914 middle of right column); wherein, there is no teaching or suggestion of the instant

independent claims; as, there is no teaching for use of a polyquaternary ammonium compound with a cationic or an anionic polyacrylamide.

Third, the Examiner refers to Ohara, p. 921. Applicant has reviewed Ohara, p. 921, finding point 3 to teach "Combinations of dewatering chemicals were often more effective than single materials (for example, anionic, cationic, or nonionic polymers alone)"; wherein, there is no teaching or suggestion of the instant invention independent claims; as, there is no teaching or suggestion for use of a polyquaternary ammonium compound with a cationic or an anionic polyacrylamide.

Fourth, the Examiner refers to Ohara, p. 914 right column. Applicant has thoroughly reviewed Ohara, p. 914 right column, finding Ohara to teach that "a combination of anionic and cationic polymers worked best" (Ohara, p. 914 middle of right column); wherein, there is no teaching or suggestion of the instant instant independent claims, as there is no teaching for use of a polyquaternary ammonium compound with a cationic or an anionic polyacrylamide.

Lastly, in Ohara, there is no teaching to dewater with a polyquaternary ammonium compound, much less to dewater biological sludge from a thermophilic digestion process with a polyquaternary ammonium compound, as claimed in instant independent claim 33, and compositionally claimed in instant independent claims 55 and 67.

Next the Examiner refers to Jones; wherein, Applicant has thoroughly reviewed the Examiner's citations, finding: 1) Jones, col. 1 lin3 64 to col. 2 line 2:

> **Accordingly it is necessary, at present, to keep them apart and if both types are to be used they are both generally dosed sequentially into the suspension as preformed aqueous solutions. In a typical process, a coagulant is added to cause coagulation-flocculation and a bridging flocculant is added subsequently to bridge-flocculate the coagulated material.**

;

col. 3 lines 40 to 46:

> **The first and second solid flocculants can be added sequentially to the suspension but preferably they are added substantially simultaneously. The preferred way of performing the invention comprises adding both flocculants at the same place since it is then possible to add both flocculants using a single dosing system. Preferably the flocculants are provided as a previously blended mixture of the solid particles.**

;

col. 4 lines 19 to 21:

> **Coagulant flocculants can be anionic but are generally cationic. They generally have intrinsic viscosity between 0.2 and 3 dl/g.** ;

col. 4 line 63 to col. 5 line 12:

> **Preferred cationic monomers are dialkylaminoalkyl (meth) -acrylates and -acrylamides, as acid addition or, preferably, quaternary ammonium salts, and diallyl dialkyl ammonium halides. The preferred acrylates and methacrylates are preferably di-C_{1-4} alkylaminoethyl (meth) acrylates and the preferred acrylamides are di-C_{1-4} alkylaminopropyl (meth) acrylamides, in particular dimethylaminoethyl (meth) acrylate and dimethylaminopropyl (meth) acrylamide (with the respective methacrylate and methacrylamide compounds being particularly preferred) as acid addition and, preferably, quaternary ammonium salts. For most purposes the most suitable cationic monomer is diallyl dimethyl ammonium chloride. Generally a single cationic monomer is used, but if desired a copolymer may be formed, for instance from diallyl dimethyl ammonium chloride and dimethylaminopropyl methacrylamide salt, generally with the latter in a minor proportion.** ;

col. 5 lines 24 to 29:

> **Particularly preferred polymers for use in the invention are polymers of diallyl dimethyl ammonium chloride, generally as homopolymers but optionally with up to 20% of other monomer, generally acrylamide, having IV of about 0.6 to 3, most preferably around 0.8 to 2.5 dl/g. Preferably the polymer is in the form of beads.** ;

col. 2 lines 24 to 26:

> **mers are still provided as aqueous concentrates. For instance, a widely used coagulant polymer is polydiallyldimethyl ammonium chloride. Many manufacturers** ;

col. 6 lines 25 to 27:

> **Suitable coagulant solid polymers are available from Allied Colloids Limited under the trade names Magnafloc 368 (polydiallydimethyl ammonium chloride) and Versicol S11 (polysodium acrylate molecular weight about 250,000).** ;

and, col. 7 lines 60 to 68:

> **The suspensions that can be treated in the invention can be inorganic or organic. They can be tailings from a coal washery or iron ore concentrator, china clay effluents and other suspensions, red mud washery liquors contaminated with colloidal humate (since the process of the invention can give good decolourisation), cellulosic suspensions, sewage and sewage sludges, textile industry effluents, and the treatment of potable water.**

Therefore, Jones teaches **simultaneous addition** of the cationic coagulant and the counterionic (anionic) flocculant, or preferably as a premixed blend.

Therefore, Jones ***teaches away*** from instant independent claim 1, which requires in addition to the polyquaternary ammonium compound "adding to the biological sludge **a cationic polyacrylamide or separate from the polymeric quaternary ammonium compound adding an anionic polyacrylamide**". And in addition, the combination of Ohara and Jones does not teach instant independent claims 22, 33, 41, 48, 55 or 67, as neither Ohara nor Jones, nor Ohara and Jones in combination teach or suggest to dewater with a polyquaternary amine alone nor teach or suggest a sludge composition, much less a sludge composition as claimed.

<u>Examiner Rejection</u>

Per claims 10 and 45, Jones describes a lower MW coagulant : higher MW flocculent weight ratio of 10:1, as claimed.

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection.

In regard to instant dependent claim 10, Applicant would like to respectfully quote, "If an independent claim is non-obvious under 35 U.S.C. 103, then any claim depending there from is non-obvious"[1]. As Applicant has respectfully traversed the Examiner's Rejection of instant independent claim 1, from which claim 10 depends.

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[1] ***MPEP 2143.03***; ***In re Fine***, 837 F2d.1071, 5 USPQ 2d 1596, Fed. Cir. 1988.

In regard to instant dependent claim 45, Jones does not teach "wherein the ratio of said polymeric quaternary ammonium compound to dais polyacrylamide is in the range of about 1:10 to about 20:1", as claimed in instant dependent claim 45.

Examiner Rejection

Per claim 11, Jones describes the bridging flocculent polymer as at least 10%, at least 50%, or at least 80% ionic, with the remainder being nonionic (col 5 lines 40 - 45. Accordingly, insofar as Jones has identified percentage ionic character of the bridging flocculent as a known result-effective process parameter, it would have been obvious to have optimized this parameter through routine experimentation.

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection. Applicant refers to the Examiner's citation, Jones col. 5 lines 38 to 45:

> **The bridging flocculant can be an alkali metal salt of an anionic naturally occurring polymer or of a modified naturally occurring polymer, but is preferably a synthetic polymer formed from a water soluble ethylenically unsaturated monomer or monomer blend. Generally at least 10%, and often at least 50% and frequently at least 80% of the monomers are ionic with any other monomers being non-ionic.**

Therefore, Jones does not teach "said anionic polyacrylamide is about 40% anionic", as is claimed in instant dependent claim 11.

Examiner Rejection

Per claims 12, 52 Jones describes a preferred weight ratio of the lower MW quaternized coagulant to the higher MW polyacrylamide bridging flocculent of about 10:1 – 1:10 (col 7 lines 4 - 11).

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection.

Applicant refers to the Examiner's citation, Jones col. 7 lines 4 to 11:

> **The proportions of coagulant flocculant:bridging flocculant can be selected through a wide range, typically 10:1 to 1:10 by weight. When, as is preferred, the flocculants consist of a coagulant flocculant and a bridging flocculant, the amount of coagulant is generally at least as much, and preferably more than, the amount of bridging flocculant and so preferred proportions are then 10:1 to 1:1, often 6:1 to 2:1 (by weight).**

Applicant respectfully presents that Jones does not teach or suggest "the ratio of said polymeric quaternary ammonium compound to said anionic polyacrylamide ranges from about 1:10 to about 20:1", as is claimed in instant dependent claims 12 and 52.

<u>Examiner Rejection</u>

Per claims 13, 37, 40, 46, 53 the dewatering polymer dosage is a known result-effective process parameter, as shown by Jones (Example I, col 8 lines 34 – 47), so optimization of the same through routine experimentation would have been obvious.

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection.

Applicant respectfully presents that Ohara does not teach the instant dependent claims; as, Ohara teaches for the dewatering of a thermophilic sludge at dosages of 8 to 12 pounds of polymer per ton of dry sludge (Ohara, Fig. 5, Table III & Table V) for a sludge concentration of 1.67-3.64% (Ohara, Table II), which correlates to a dosage of 40 to 60 ppm polymer/% solids [(8 X 0.01) X 10^6/2000 to (12 X 0.01) X 10^6/2000]. In contrast, instant claims 13, 37, 40, 46 and 53 are each limited to 50 to 300 ppm polymer/% solids.

<u>Examiner Rejection</u>

Per claim 47 Jones describes the high MW bridging flocculent polymer as having a MW of at least 5 million (col 1 line 18).

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection.

Applicant refers to the Examiner's citation, Jones col. 1, lines 18 to 20:

> **Bridging flocculants must have high molecular weight, generally above 5 million and frequently above 10 million.**

Applicant respectfully presents that Jones does not teach or suggest "said polyacrylamide comprises a cationic moiety having a molecular weight in the range of about 5,000,000 to about 16,000,000 or wherein, said polyacrylamide comprises a cationic moiety having a molecular weight in the range of about 5,000,000 to about 15,000,000", as is claimed in instant dependent claim 47.

Examiner Rejection

Per claims 24, 47, and 54, Jones describes the coagulant polymer having a MW range of 100,000 – 2 million (col 4 lines 22 - 29).

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection.

Applicant refers to the Examiner's citation, Jones col. 4 lines 22 to 29:

> **When the coagulant polymer is cationic, intrinsic viscosity is generally at least about 0.2, preferably in the range of about 0.5 to 3, most preferably around 0.8 to 2.4 dl/g. Expressed in terms of molecular weight, it is generally preferred for the molecular weight t be below 2 million, most preferably below 1.5 and, preferably, below 1 million, although it should generally be above 100,000 and preferably above 500,000.**

Applicant respectfully presents that Jones does not teach or suggest "said polymeric quaternary ammonium compound comprises a molecular weight in the range of about 500,000 to about 3,000,000", as is claimed in instant dependent claims 24, 47 and 54.

Applicant has respectfully traversed rejections of the Examiner. Applicant respectfully requests allowance of instant claims 1, 2, 3, 8, 10 – 13, 33, 35 – 38, 40 – 41, 44 – 48, 51 – 55, 58 and 67 – 70, as presented herein.

Examiner Rejection

Claims 1 – 7, 15 – 16, 22, 24 – 28, 33, 35 – 37, 41, 44 – 48, 51 – 55, 58, 67 – 70, 73 are rejected under 35 U.S.C. 103(a) as being unpatentable over McGrow in view of Ohara.

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection.

Applicant respectfully presents that Ohara teaches use of a cationic and an anionic polymer; as, Ohara teaches that "a combination of anionic and cationic polymers worked best" (Ohara, p. 914 middle of right column). While, as presented by the Examiner:

> USP 5213693 to McGrow describes a method of facilitating the dewatering of a digested activated (i.e., biological) sewage sludge suspension (col 7 line 49) by adding a solution containing both a low molecular weight quaternized coagulant compound, e.g., poly(DADMAC)(col 4 line 37) or a polyamine made by condensation of epichlorohydrin with an amine (col 4 line 29), and a high molecular weight cationic polyacrylamide flocculent (col 5 line 55) to the sewage sludge suspension (Example I). The polymers may be added as a blended solution or as separate solutions added to the suspension "substantially simultaneously" (column 7 lines 10). McGrow teaches that use of the poly(DADMAC) or poly(epichlorohydrin-amine) in addition to the cationic polyacrylamide offers numerous advantages over the traditional methods of using the high molecular weight cationic polymeric flocculent alone (col 6 line 30).

Therefore, one of ordinary skill in the art would not reasonably use Ohara in view of McGrow; as, Ohara and McGrow teach different methods or processes, e.g. Ohara teaches in combination cationic and anionic vs. McGrow whom teaches in combination cationic coagulant and cationic polyacrylamide.

Examiner Rejection

Per claims 5 - 6, 27, 45, 52 McGrow describes a preferred weight ratio of the lower MW quaternized coagulant to the higher MW polyacrylamide flocculent of about 0.7:2 (col 5 line 57-63).

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection.

Applicant respectfully presents that McGrow does not teach or suggest "said polymeric quaternary ammonium compound and said cationic polyacrylamide are in an approximate 1:1 ratio", as is claimed in instant dependent claim 5.

Further, Applicant respectfully presents that McGrow does not teach or suggest "the ratio of said polymeric quaternary ammonium compound with respect to said cationic polyacrylamide range from about 1:10 to about 20:1", as is claimed in instant dependent claims 6, 27, 45 and 52.

Examiner Rejection

Per claims 7, 28, 37, 46, 53, the dewatering polymer dosage is a known result-effective process parameter, so optimization of the same through routine experimentation would have been obvious.

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection.

Applicant respectfully presents that Ohara does not teach the instant dependent claims; as, Ohara teaches for the dewatering of a thermophilic sludge at dosages of 8 to 12 pounds of polymer per ton of dry sludge (Ohara, Fig. 5, Table III & Table V) for a sludge concentration of 1.67-3.64% (Ohara, Table II), which correlates to a dosage of 40 to 60 ppm polymer/% solids [(8 X 0.01) X 10^6/2000 to (12 X 0.01) X 10^6/2000]. In contrast, instant claims 13, 37, 40, 46 and 53 are each limited to 50 to 300 ppm polymer/% solids.

Examiner Rejection

Per claim 22, "substantially simultaneously," as described in McGrow and discussed above, covers both simultaneous addition of separate solutions of the polymers, as well as addition of one polymer followed soon thereafter by the addition of the other polymer solution.

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection.

Applicant, again, respectfully presents that Ohara teaches use of a cationic and an anionic polymer; as, Ohara teaches that "a combination of anionic and cationic polymers worked best" (Ohara, p. 914 middle of right column). While, as presented by the Examiner:

> USP 5213693 to McGrow describes a method of facilitating the dewatering of a digested activated (i.e., biological) sewage sludge suspension (col 7 line 49) by adding a solution containing both a low molecular weight quaternized coagulant compound, e.g., poly(DADMAC)(col 4 line 37) or a polyamine made by condensation of epichlorohydrin with an amine (col 4 line 29), and a high molecular weight cationic polyacrylamide flocculent (col 5 line 55) to the sewage sludge suspension (Example I). The polymers may be added as a blended solution or as separate solutions added to the suspension "substantially simultaneously" (column 7 lines 10). McGrow teaches that use of the poly(DADMAC) or poly(epichlorohydrin-amine) in addition to the cationic polyacrylamide offers numerous advantages over the traditional methods of using the high molecular weight cationic polymeric flocculent alone (col 6 line 30).

Therefore, one of ordinary skill in the art would not reasonably use Ohara in view of McGrow; as, Ohara and McGrow teach different methods or processes, e.g. Ohara teaches in combination cationic and anionic vs. McGrow whom teaches in combination cationic coagulant and cationic polyacrylamide.

Examiner Rejection

Per claims 24 and 54, McGrow describes the coagulant polymer having a MW range of 100,000 – 3 million (col 3 line 47).

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection.

In regard to instant dependent claims 24 and 54, Applicant would like to respectfully quote, "If an independent claim is non-obvious under 35 U.S.C. 103, then any claim depending there from is non-obvious"[2]. As Applicant has respectfully traversed the Examiner's Rejection

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[2] ***MPEP 2143.03***; ***In re Fine***, 837 F2d.1071, 5 USPQ 2d 1596, Fed. Cir. 1988.

of instant independent claim 22 from which claim 24 depends and respectfully traversed the Examiner's Rejection of instant independent claim 48 from which claim 54 depends, Applicant has respectfully traversed the Examiner's Rejection of instant claims 24 and 54.

Examiner Rejection

Per claim 47, McGrow describes the high MW flocculent polymer as having a MW of at least 5 million (col 4 line 47).

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection.

In regard to instant dependent claim 47, Applicant would like to respectfully quote, "If an independent claim is non-obvious under 35 U.S.C. 103, then any claim depending there from is non-obvious"[3]. As Applicant has respectfully traversed the Examiner's Rejection of instant independent claim 41 from which claim 47 depends, Applicant has respectfully traversed the Examiner's Rejection of instant claim 47.

Examiner Rejection

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohara and Jones, or over McGrow and Ohara, each combination as applied to claim 1 above, further in view of either USP 1999973 to Gentler or USP 3023162 to Fordyce. Genter at Sheet 3 describes mixing a primary sludge (labeled as "raw sludge") with step "No. 5" which is immediately downstream of the digestion step. Fordyce describes mixing primary sludge with digested sludge (col 5 lines 8 – 9). It would have been obvious to have mixed the biological sludge of either Ohara (as modified by Jones) or McGrow (as modified by Ohara) with primary sludge insofar as such practice was conventional, as shown by Fordyce or Genter.

[3] ***MPEP 2143.03***; ***In re Fine***, 837 F2d.1071, 5 USPQ 2d 1596, Fed. Cir. 1988.

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection.

In regard to instant dependent claim 14, Applicant would like to respectfully quote, "If an independent claim is non-obvious under 35 U.S.C. 103, then any claim depending there from is non-obvious"[4]. As Applicant has respectfully traversed the Examiner's Rejections of instant independent claim 1 from which claim 14 depends, Applicant has respectfully traversed the Examiner's Rejection of instant dependent claim 14.

Applicant has respectfully traversed rejections of the Examiner. Applicant respectfully requests allowance of instant claims 1 – 7, 15 – 16, 22, 24 – 28, 33, 35 – 37, 41, 44 – 48, 51 – 55, 58 and 67 – 70, as presented herein.

Examiner Rejection

Claims 1, 4 – 8, 10 – 13, 16 are rejected under 35 U.S.C. 102(e) as being anticipated by USP 5593591 to Ohsol.

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection.

Applicant respectfully refers to instant independent claim 1:

1. A method for dewatering biological sludge from a thermophilic digestion process, comprising:

a. adding a polymeric quaternary ammonium compound, as primary component, to the biological sludge; and

b. adding to the biological sludge a cationic polyacrylamide or separate from the polymeric quaternary ammonium compound adding an anionic polyacrylamide;

such that the polymeric quaternary ammonium compound and the polyacrylamide[s] enhance dewatering of the sludge.

Applicant respectfully presents to the Examiner that "[U]nless a reference discloses within the four corners of the document not only all of the limitations claimed but also all of the limitations *arranged or combined in the same way as recited in the claim,* it cannot be said to prove prior invention of the thing claimed and, thus, cannot anticipate under 35 U.S.C. § 102"[5]. Wherein, the instant independent claim is limited to "biological sludge from a thermophilic digestion process"; and wherein, Ohsol does not disclose, teach or suggest a thermophilic digestion process.

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[4] ***MPEP 2143.03***; ***In re Fine***, 837 F2d.1071, 5 USPQ 2d 1596, Fed. Cir. 1988.
[5] ***Net MoneyIN, Inc.*** v. ***Verisign, Inc.***, 545 F.3d 1359, 1371 (Fed. Cir. 2008).

First, Applicant obtained an electronic version of Ohsol from www.uspto.gov; with which, Applicant performed a word search for "digest" and "thermo"; finding, neither term or phrase exists in Ohsol. Therefore, Ohsol does not use terminology of the industry as is known by those of ordinary skill in the art as the term would relate to thermophilic digestion.

Second, using inference, as presented by the Examiner, any system comprising bacteria and water at a temperature of greater than about 120 °F for any period of time is a thermophilic digester. Such is simply not the art.

Applicant defines digestion in the instant application. The instant application defines digestion in col. 1, lines 53-55:

> Digestion is applied to reduce the sludge volume by the consumption of the wasted bacteria from the treatment system by other bacteria or by each other.

Applicants use and definition of the term digestion fits well within that of industry. The USEPA, a pre-eminent authority, defines digestion as "The biochemical decomposition of organic matter, resulting in partial gasification, liquefaction, and mineralization of pollutants."[6]

In conclusion, Ohsol does not anticipate the instant claims.

Examiner Rejection

Per claims 5, 12, Ohsol teaches that the amount of quaternized ammonium compound-containing complexing agent added to the sludge is a result-effective variable (col 8 lines 9 – 11), so optimization of this process variable is within the level of skill in the art and obvious. The molecular weight of the polyacrylamide flocculent is as high as 5,000,000 (col 7 line 3).

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection.

Applicant respectfully presents that Ohsol does not disclose all of the limitations arranged or combined in the same way as recited in the claim[7], "said polymeric quaternary ammonium

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[6] http://www.epa.gov/iaq/largebldgs/i-beam/glossary.html#D.

[7] ***Net MoneyIN, Inc.* v. *Verisign, Inc.***, 545 F.3d 1359, 1371 (Fed. Cir. 2008).

compound and said cationic polyacrylamide are in an approximate 1:1 ratio", as claimed in instant dependent claim 5.

Applicant further, respectfully presents that Ohsol does not disclose all of the limitations arranged or combined in the same way as recited in the claim[7], "the ratio of said polymeric quaternary ammonium compound to said anionic polyacrylamide ranges from about 1:10 to about 20:1", as is claimed in instant dependent claim 12.

Examiner Rejection

Per claims 6, 7, 12, 13 Ohsol teaches that the amount of flocculent added is a result-effective variable (col 7 lines 38 – 47), so optimization of the floccuent dosage is within the level of skill in the art and obvious.

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection.

Applicant respectfully presents that Ohsol does not disclose all of the limitations arranged or combined in the same way as recited in the claim[7], "the ratio of said polymeric quaternary ammonium compound with respect to said cationic polyacrylamide range from about 1:10 to about 20:1", as claimed in instant dependent claim 6.

Applicant further, respectfully presents that Ohsol does not disclose all of the limitations arranged or combined in the same way as recited in the claim[7], "the polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids component of the sludge is between about 50 ppm:1 percent and about 300 ppm:1 percent", as claimed in instant dependent claim 7.

Applicant respectfully further still presents that Ohsol does not disclose all of the limitations arranged or combined in the same way as recited in the claim[7], "said polymeric quaternary ammonium compound to said anionic polyacrylamide ranges from about 1:10 to about 20:1", as claimed in instant dependent claim 12.

Applicant respectfully still further presents that Ohsol does not disclose all of the limitations arranged or combined in the same way as recited in the claim[7], "the polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids

component of the sludge is between approximately 50 ppm:1 percent and approximately 300 ppm:1 percent", as claimed in instant dependent claim 13.

Lastly, should the Examiner not find Applicant's Arguments persuasive in regard to instant dependent claims 5, 6, 7, 12, and 13, Applicant presents that he has respectfully traversed the Examiner's Rejection of instant independent claim 1 from which instant dependent claims 5, 6, 7, 12 and 13 depend; therefore, should the Examiner not find Applicant's dependent claim arguments as persuasive, instant dependent claims 5, 6, 7, 12 and 13 are allowable as each depend on instant independent claim 1.[4]

Examiner Rejection

Per claim 11, Ohsol teaches that the degree of hydrolysis and charge density of the polyacrylamide flocculents is a known result-effective variable, so optimization of the same would have been obvious.

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection.

Applicant respectfully presents that Ohsol does not disclose all of the limitations arranged or combined in the same way as recited in the claim[7], "said anionic polyacrylamide is about 40% anionic", as claimed in instant dependent claim 11.

Examiner Rejection

Per claim 16, Ohsol describes addition of solutions of flocculent (col 7 lines 27 – 38)

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his rejection.

Applicant respectfully presents that Ohsol does not disclose all of the limitations arranged or combined in the same way as recited in the claim[7], "said cationic or anionic polyacrylamide and said polymeric quaternary ammonium compound are added in solution form", as claimed in instant dependent claim 11.

Applicant has respectfully traversed rejections of the Examiner. Applicant respectfully requests allowance of instant claims 17, 4 – 8, 10 – 13 and 16, as presented herein.

Examiner Rejection

Claims 1 – 2, 4 – 8, 10 – 16, 22, 24-28, 33, 35-37, 41, 44, 45- 48, 51-55, 58, 67-70, 73 are rejected under 35 U.S.C. 103(a) as being unpatentable over USP 5019267 to Eberhard in view of USP 5213693 to McGrow (incorporating 5178774 to Payne) and USP 5561520 to Willliams.

Applicant's Response

Applicant appreciates the Examiner's effort. Applicant refers to McGrow col. 2:

> Accordingly the commercially preferred process involved the adoption of a single treatment using a conventional high molecular weight cationic flocculant polymer, typically intrinsic viscosity 6 to 8 dl/g. This greatly reduces the treatment costs and gives results that have been considered adequate. However if the doses are not controlled accurately, and if overdosing occurs, there is a tendency to form large gelatinous flocs which can release free water very quickly and cause blockage of feed holes, this effect being known as coring. Coring prevents full utilisation of the press chambers and so results in reduction in the volume of sludge that can be processed and it reduces the dry solids content of the resultant cake. Reducing the dose can permit better filling of the filter press but filterability is still inferior, leading to increased cycle time and reduced cake dry solids.

Emphasis added

McGrow states again in col. 6 lines 30 - 45:

> Compared to the traditional methods using the high molecular weight flocculant alone, the method of the invention gives numerous advantages. The flocs are small, evenly structured and highly filterable and have good shear stability, and the system is relatively resistant to overdosing. Thus the risk of the formation of gelatinous flocs with the consequential disadvantages of coring and reduced productivity can be avoided.

Emphasis added

Therefore, while McGrow DOES NOT teach the dewatering of bio-solids from a thermophilic digestion process, McGrow specifically teaches that the use of a cationic polyacrylamide alone "greatly reduces the treatment costs and gives results that have been considered adequate". Referencing instant specification Examples, Applicant respectfully presents that a cationic polyacrylamide alone does NOT dewater a sludge digested by a thermophilic digestion process

"greatly reduc[ing] the treatment costs and giving results that have been considered adequate". Therefore, it is obvious that ***McGrow is applied to a different application, e.g. a different purpose or a different problem, than that of the instant claims, while not teaching or motivating one of ordinary skill in the art to attempt or try the instant claims.*** (ref. MPEP 2141.02 III) .

McGrow, then, goes on to state that the McGrow invention provides "resistan[ce] to overdosing. Thus the risk of the formation of gelatinous flocs and coring *(from overdosing)* and the associated reduced productivity can be avoided". ***Therefore, the teaching of McGrow is in the case of gelatin formation or coring resulting from overdosing. Neither of these challenges are taught or suggested in the instant application, nor found to occur.*** (ref. declaration of Audrey L. Haase)

In contrast to McGrow, as is taught by Applicant, the dewatering of bio-solids from a thermophilic digestion process relate to the "***need to form of a floc***" (ref. declaration of Audrey L. Haase) that dewaters well as compared to mesophiles, specifically col. 1 lines 30 -55 states:

> "Meanwhile, traditional polyacrylamide polymers used for dewatering have been shown to perform very poorly in tests for dewatering of sludge that has been digested by any thermophilic digestion process. The goal of dewatering is to convert the sludge to a cake of such dryness that the dewatered sludge can be hauled as a solid to a final disposal site at minimal cost. To minimize the amount of sludge to be handled and to minimize dewatering and handling costs associated with the wasted sludge, most biological treatment systems waste the sludge to a digester or a digestion system."

Further, the instant specification states in col. 2 lines 25 – 36 state:

> "Despite the disadvantages of mesophilic bacteria, mesophilic bacteria are preferable in relation to the dewatering of digested sludge. Mesophilic bacteria naturally secrete a polysaccharide which acts as a tackifier providing a chemical mechanism of floc formation. This chemical mechanism is an aid to traditional cationic polyacrylamides to begin the dewatering process. However, thermophilic bacteria do not secrete a tackifying polysaccharide. Furthermore, thermophilic bacteria naturally repel each other. This repelling nature of thermophilic bacteria makes the dewatering of sludge from the thermophilic digestion process expensive and difficult."

Applicant also teaches and demonstrates in col. 4 lines 59 – 65:

> "The best performing traditional polyacrylamide technology utilized at the site of this invention was Nalco 9909, manufactured by Nalco Chemical, Inc. Usage of Nalco 9909 results in **a dry polymer dosage often near 2,000 ppm and usually near 1,700 ppm treating sludge near 4 percent solids. Even at this dosage, plant throughput was at 20 percent of rated capacity**." **(Emphasis added)**

This horrendous chemical dosage, 2000 ppm, is greater than any teaching or example within McGrow, which taught an **overdose** situation comprising ***gelatin or coring; therefore, without gelatin or coring challenges, there is no rational reason for one of ordinary skill in the art to apply McGrow to the dewatering of biological sludge from a thermophilic digestion process.***

In conclusion, then, given the teachings of McGrow in combination with the dewatering thermophiles, there is no teaching or suggestion in McGrow for one of ordinary skill in the art to try the instant claims; as, McGrow teaches a solution to a different problem (purpose), which is specifically related to either gelatin formation or coring, which are after floc formation and in stark contrast to the problem (purpose) associated with thermophiles, which is floc formation[8]. ***Therefore, the only means by which the Examiner could find the instant claim obvious with McGrow is via hindsight reconstruction[9].***

This is while an article by Dentel, Steven K. and Chitikela, Srinivasarao; Evaluation of Dual Chemical Conditioning and Dewatering of Anaerobically Digested Biosolids The Final Report Sludge Dewaterability Assessment for East Bay Municipal Utility District (EBMUD) California, June 1995 (Dentel 1995), and previously cited in this proceeding concludes on page 9 that:

> "As a rule of thumb, it appears that adding a proportion of one chemical's optimum dosage reduces the requirement for the other by the same amount.... If this rule were invariably true, it would always be most economical to use only one of the conditioning chemicals by itself. However, the CST results also indicated that sole use of ferric chloride or HDTMA (quaternary salt) did not provide adequate dewaterability even at the optimum dose..."

And, on page 11 that:

> "The use of ferric chloride or HDTMA (a quaternary salt) as a preconditioner can reduce the polymer requirement, this is not a cost effective option at current prices for these additives."

Therefore, in 1996, **time of the instant invention**, it was not known to economically "precondition" a biological sludge with a polyquaternary amine, ***regardless of the teachings of McGrow in 1993***. If McGrow made it obvious to precondition bio-solids with a polyquaternary ammine, then why did Dentel and Chitikela, working for a well established University, directly ***teach away*** from McGrow

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[8] ***MPEP 2141.02 III***; ***In re Wiseman***, 596 F.2d 1019, 201 USPQ 658 (CCPA 1979); ***In re Kaslow***, 707 F.2d 1366, 217 USPQ 1089 (Fed. Cir. 1983)

[9] ***MPEP 2141.02 VI; 2141.03 VI; 2144.05 III; 2144.07 III; 2144.08(c) & 2145 X D; KSR Int'l Co. v. Teleflex, Inc.***, 550 U.S. 398 (2007).

3 ***years later and at a time which is closer to the time of the instant invention***? It is painfully obvious that McGrow did not even make it obvious to **economically** precondition mesophilic biological sludge with a polyquaternary ammine, **much less** teach to economically precondition **thermophilic** biological sludge with a polyquaternary amine, per the instant claims.

The Dentel 1995 and Chitikela 1996 articles are timelier to the instant invention in 1996 than is McGrow in 1993. Therefore, Dentel 1995 and Chitikela 1996 are much closer references to the instant invention and the instant claims than is McGrow[10].

The above is while Dentel 1995 further states on page 2 that:

> "The success of any conditioning process will also depend on the specific dewatering process employed.
>
> Thus, the conditioning process is **a multivariate problem with no simple strategy available for optimization**. At present, the required dosages for chemical conditioners must be determined empirically. With this being the case, **the use of multiple chemical additives becomes less feasible because of the difficulty in identifying a proper dosage combination**." **(Emphasis added)**

And, Chitikela 1996 further states:

> "The success of any conditioning process will also depend on the specific dewatering process employed. Thus, the sludge conditioning process is a multivariate problem with no simple strategy available for its optimization. At present, the required dosages for chemical conditioners must be determined empirically. With this being the case, the use of multiple chemical additives become less feasible because of the difficulty in identifying a proper dose combination."

Therefore, the instant invention could not have been obvious at the time of filing for the instant invention; as, both Dentel 1995 and Chitikela 1996 ***taught not to practice the instant claims*** (***teach away***); and at the time of the instant invention, it was "less feasible" to develop the instant invention due to the "difficulty" of a "multivariate problem". This teaching is presented for a **traditional mesophilic biological sludge**; while, the difficulty is enhanced and the feasibility is reduced with the further complication of a **thermophilic biological sludge** (undue experimentation to develop the instant claims), which is a different application, purpose or problem.

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[10] ***MPEP 716.02(e)***; ***In re Geiger***, 815 F.2d 686, 689, 2 USPQ2d 1276, 1279 (Fed. Cir. 1987); ***In re Holladay***, 584 F.2d 384, 199 USPQ 516 (CCPA 1978); ***Ex parte Humber***, 217 USPQ 265 (Bd. App. 1961).

The above statements and teachings from June 1995 and August 1996 are with the instant application, e.g. 08/721,557, filed on 09/26/96. Therefore, at the time of the instant invention, "**means by which chemical conditioners interact with the colloidal phase in biological suspensions to facilitate the release of water [was] poorly understood**", ***even after McGrow***. This is while at the time of the instant invention, Dentel 1995 and Chitikela 1996 demonstrate and teach that "**the optimal amounts and types of conditioners required depending on a variety of factors**": 1) "**aqueous and surface chemistries of the sludge**", 2) "**physical properties of the suspended solids, which are determined by characteristics of the original wastewater and by the operational parameters for the various treatment processes employed with the plant**", and 3) "**the chemistry of any chemical conditioner used, and how it interacts with the biosolids**".

These teachings, at the time of the instant invention, are while none of the cited references alone or in combination teach a "method for dewatering thermophilic biological sludge" comprising any of these factors. This is regardless of the application purpose. However, and in strong contrast, the instant invention teaches all three factors in the dewatering of a thermophilic biological sludge. Specifically, 1) "aqueous and surface chemistries of the sludge" in column 2:

> Despite the disadvantages of mesophyllic bacteria, mesophyllic bacteria are preferable in relation to the dewatering of digested sludge. Mesophyllic bacteria naturally secrete a polysaccharide which acts as a tackifier providing a chemical mechanism of floc formation. This chemical mechanism is an aid to traditional cationic polyacrylamides to begin the dewatering process. However, thermophilic bacteria do not secrete a tackifying polysaccharide. Furthermore, thermophilic bacteria naturally repel each other. This repelling nature of thermophilic bacteria makes the dewatering of sludge from the thermophilic digestion process expensive and difficult.

The instant invention also teaches, 2) "physical properties of the suspended solids, which are determined by characteristics of the original wastewater and by the operational parameters for the various treatment processes employed with the plant" in column 2:

> At temperatures of at least about 115° F., active bacteria are of the thermophilic variety. Aerobic and/or anaerobic thermophilic microorganisms are used to carry out any required degradation in a thermophilic,

exothermic process. The thermophilic digestion system relies on high operating temperatures (greater than about 55° C. or 131° F.) to achieve a substantial pathogen destruction. While a fraction of the energy released from the thermophilic process is stored intracellularly to form new cells, a larger fraction of the energy is released as heat into the environment. The released heat is the major heat source used to achieve the desired operating temperature. Experiments have shown that between about 8,500 and 13,000 BTU are released with the thermophilic digestion of one pound of volatile solids (bacteria). By maintaining a sufficient temperature for a required period of time, pathogenic organisms are reduced to below detectable levels.

Lastly, the instant invention teaches, 3) "the chemistry of any chemical conditioner used, and how it interacts with the biosolids" in column 5:

The significant improvements of this invention in sludge dewatering are accomplished by the addition of polyquaternary amines to the sludge. Di-allyl di-methyl ammonium chlorides (DADMAC) and epichlorohydrin di-methyl amine (epi-DMA) are two preferred polyquaternary amines used in sludge dewatering. Both of these polyquaternary amine moieties have been found to provide sites for the dewatering of sludge from the thermophilic digestion process.

And, again in column 7:

EXAMPLE 1

A bench test was performed utilizing an electrical variable speed beaker stir system, commonly referred to as a jar test. 2000 ppm of CV 3750 (20% active) were added to 500 mnl of sludge from the thermophilic digestion system. The percentage of solids in the sludge was about 4.4 percent. The beaker was allowed to stir at 120 rpm for 30 seconds. At 30 seconds, the rpm was reduced to 90 and 1500 ppm of CV 5120 in a 0.25 percent solution were added to the beaker. After 15 seconds, the stir speed was slowed to 30 rpm and mixed for another 30 seconds. Large, heavy floc (e.g. with a diameter of at least about 4 mm) was formed with a somewhat cloudy supernatant.

And, again in column 9:

EXAMPLE 7

A plant test was performed on Sep. 10, 1996 at the municipal wastewater treatment facility for the City of College Station Texas. This facility has a thermophilic digestion system as designed by Kruger, Inc. The average

> temperature of the digester is usually near 65° C. Dewatering is accomplished on a Sharpels Polymixer 75000 centrifuge. Polymer inversion is accomplished on a Polymixer 500 which is designed for a dry polymer. Normal plant operation requires 1500 to 2000 ppm of Nalco 9909 obtaining variable sludge cake dryness, a final centrate that is usually much over 200 ppm of total suspended solid and a plant throughput of 10 to 15 gpm sludge. The centrifuge was started up on CV 5380 and Nalco 9909 with the CV 5380 having a polymer concentration of 400 ppm and the Nalco 9909 having a concentration of 450 ppm. The centrifuge was run between 45 and 55 gpm of sludge throughput. The produced sludge was over 18 percent cake solids. The centrate was less than 50 TSS.

And again, in column 5, lines 2 - 4:

> The significant improvements of this invention in sludge dewatering are accomplished by the addition of polyquaternary amines to the sludge.

Therefore, while at the time of the instant invention "means by which chemical conditioners interact with the colloidal phase in biological suspensions to facilitate the release of water was poorly understood", it was known at the time of the instant invention that three teachings were needed to understand said means, all of which are taught by Applicant in the instant specification; again: "Aqueous and surface chemistries of the sludge"; "Physical properties of the suspended solids, which are determined by characteristics of the original wastewater and by the operational parameters for the various treatment processes employed with the plant"; and "The chemistry of any chemical conditioner used, and how it interacts with the biosolids".

Therefore, as previously presented and is furthered herein, ***Applicant discovered "the source of the problem" and taught a solution to "the source of the problem" in the instant specification, <u>as required by the art at the time of the instant invention</u>.*** This is while "***the source of the problem***" was not taught or suggested by others, as was required in the art and is a "clear and persuasive assertion in the instant specification"[11].

This above is while, the previously presented US EPA Document TBS Prakasam, et al. Effect of Recycling Thermophilic Sludge on the Activated Sludge Process, EPA Project Summary 5, Sept. 1990, **which is at the time of McGrow, e.g. 1993**, states under the heading of Dewaterability:

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[11] ***MPEP 2141.02 III***; ***In re Wiseman***, 596 F.2d 1019, 201 USPQ 658 (CCPA 1979).

"Capillary suction time (CST) measurements at various polymer dosages indicated that mesophilic sludge required a lower polymer dosage than did the thermophilic sludge (10 vs. 22.5 kg/dry tonne) to achieve the minimum CST that was possible. The thermophilic sludge, however, exhibited highest floc strength than did the mesophilic sludge.

Pilot scale centrifuge studies confirmed that the thermophilic sludge required a higher polymer dosage than did the mesophilic sludge. At optimal polymer dosages, those studies also indicated that the mesophilic sludge approached 100% solids capture whereas the thermophilic solids approached a maximum of 96% solids capture. The lower solids capture with thermophilic sludge probably resulted from the higher concentration of fine particles in it than in the mesophilic sludge."

The report goes on to recommend that:

"Based on the lack of effect on sludge mass end the increase in digestion capability required, the Torpsy process is not recommended for Chicago's conventional rate activated sludge plants. Nor is thermophilic digestion as the terminal sludge digestion process recommended if the sludge is to be used at a site with nearby neighbors."

The instant claims were not obvious to the industry in September 1990; when, ***the US EPA taught away from the instant claims at the same time of McGrow in the application, purpose or problem, of dewatering biological sludge from a thermophilic digestion process, as claimed***; while again, in 1995 and 1996, a recognized Municipal Authority taught away from the instant claims, presented previous. At the time of the instant invention, then, two recognized authorities taught away from the instant claims. ***Therefore, the instant claims could not have been obvious at the time of the instant invention.***

Applicant further, refers the Examiner to declarations on file in this proceeding; wherein it is evidenced, that there existed at the time of the instant invention, at College Station, Texas, and at Texarkana, Texas, difficulty to dewater biological solids from a thermophilic digestion process; while, the instant claims were not practiced; and wherein, ***it was only after teachings of Applicant that the instant claims were practiced. In College Station, instant claim 1 was practiced after demonstration by Applicant. In Texarkana, Texas it was after teachings of Applicant that instant claim 33 was practiced. These facts are furthered by use of a polyquaternary amine, instant claim 33, at the Hyperion Plant after teachings by Applicant. Therefore, at a time wherein all the Examiner's Citations were available, the instant claims were not obvious at two locations without the teachings of Applicant and are being practiced at a third after teachings of Applicant in the industry Therefore, it was only AFTER teachings of Applicant that Applicant was copied.***

In addition, at the time of the instant invention, those of ordinary skill in the art would have had available the US EPA (1990), McGrow (1993), Dentel (1995) and Chitikela (1996) references. Therefore, for one of ordinary skill in the art to have developed the instant invention and the instant claims from the Examiner's Citations, at the time of the instant invention, one of ordinary skill in the art would have had to: 1) apply McGrow to the dewatering of thermophilic bio-solids when there is no teaching in McGrow in relation to thermophilic bio-solids, 2) ignore the teachings in McGrow, which refer to gelatin formation and coring for application of McGrow, neither of which is a challenge with the dewatering of biological sludge from a thermophilic digestion process, as evidenced in the instant specification, 3) ignore the teachings of Dentel 1995 and Chitikela 1996 and apply a polyquaternary amine anyway as a pre-conditioner and regardless of economics, and 4) ignore the teachings of the US EPA, the pre-eminant authority.

Applicant presents that such an irrational path is not a path for one of ordinary skill in the art; or, for one of expert skill in the art; as, there are just too many irrational decisions which must be made with the cited references at the time of the instant specification without having the instant claims or teachings in the instant specification. Therefore, the instant claims could not have been obvious at the time of the instant application.

This is all while, due to teachings of McGrow, the only reason to go against Dentel 1995 and Chitikela 1996 would be in the instances of "***coring***" or of "***gelatin formation***", neither of which is remotely an issue with the dewatering of thermophilic bio-solids; as, ***the challenge in dewatering thermophilic bio-solids is to form a floc***; while, coring and gelatin formation relate to overdosing, which is much beyond floc formation, as is known in the art. This is all while, the instant invention is for a different purpose, e.g. the dewatering of "**thermophilic**" bio-solids **not for solving coring or gelatin formation**; and therefore, it would have been obvious to one of ordinary skill in the art that the dewatering of thermophilic bio-solids is a "***different purpose***" than that taught in McGrow. **Therefore, to one of ordinary skill in the art, the dewatering of biological sludge comprising gelatin formation or coring issues and the dewatering of biological sludge from a thermophilic digestion process are different purposes.**

Given the requirements for and rather irrational decision making required for one of ordinary skill in the art at the time of the instant invention to develop the instant invention,

Applicant respectfully states that the Examiner's cited combination, e.g. Eberhard in view of Williams and McGrow is "hindsight reconstruction"[12].

As Applicant has traversed the Examiner's Rejections, Applicant respectfully requests allowance of instant claims 1-2, 4-8, 10-16, 22, 24-28, 33, 35-37, 41, 44, 45-48, 51-55, 58, 67-70 and 73.

Examiner Rejection

Claim 14 is rejected under 35 USC Sec. 103(a) over Eberhard, McGrow, Payne and Willliams, as applied to claim 1 above, further in view of USP 3397139 to Sak.

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his response. Applicant would like to respectfully quote, "If an independent claim is non-obvious under 35 U.S.C. 103, then any claim depending there from is non-obvious"[13]. As Applicant has respectfully traversed the Examiner's Rejection of claim 1, from which claim 14 depends, Applicant respectfully requests an allowance of claim 14 as presented.

Examiner Rejection

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Eberhard, McGrow, Payne and Willliams, as applied to claim 1 above, further in view of USP 4137165 to Coscia, USP 4155847 to Tanaka, or USP 5405554 to Neff.

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his response. Applicant would like to respectfully quote, "If an independent claim is non-obvious under 35 U.S.C. 103, then any claim depending there from is non-obvious"[8]. As Applicant has respectfully traversed the Examiner's Rejection of claim 1, from which claim 3 depends, Applicant respectfully requests an allowance of claim 3 as presented.

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[12] MPEP 2144.06, 2141.01III and 2145 X; ***KSR Int'l Co. v. Teleflex, Inc.***, 550 U.S. 398 (2007).
[13] ***MPEP 2143.03***; ***In re Fine***, 837 F2d.1071, 5 USPQ 2d 1596, Fed. Cir. 1988.

Examiner Rejection

Claims 33, 35, 38, and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over USP 5019267 to Eberhard and McGrow, as applied to claim 33 above, further in view of USP 5178774 to Payne.

Applicant's Response

Applicant appreciates effort of the Examiner to formulate his rejection.

Payne teaches for a different purpose than the instant claims; Payne teaches for the dewatering of minerals. Specifically, in the Abstract, Payne teaches:

> **An aqueous suspension of coagulatable material is coagulated by adding polymeric coagulant to the suspension and then separating the resultant coagulated material from the liquor. The coagulatable material may be present in the aqueous suspension as a suspension of suspended solids or as colloidally dispersed solids. The suspension may be coal tailings or other aqueous (generally mineral) suspension.**

Emphasis added

Further, none of the Examiner's cited references, alone or in combination, teach dewatering a thermophilic biological sludge with a polymeric quaternary ammonium compound, as is claimed in the instant independent claim:

33. A method for dewatering a sludge comprising water and thermophiles, the method comprising:

adding to the sludge a polymeric quaternary ammonium compound.

Payne is totally silent on the dewatering of thermophilic sludge or any type of biological sludge for that matter. To be sure of this fact, after reviewing Payne manually, Applicant obtained an electronic copy of Payne at uspto.gov and performed a word search for: "biologic", "meso", "thermo" and "municipal"; none of these are even located in Payne.

Further, as presented by the Examiner, Eberhard does not teach a polymeric quaternary ammonium compound[14]. While as presented previously herein by Applicant, McGrow is for a different application (purpose) than the instant claims, e.g. gelatin and/or coring formation versus dewatering of biological sludge from a thermophilic digestion process, thermophiles, which have an

[14] 9/22/10 Office Action, p. 8.

issue of floc formation. Gelatin and/or coring formation is in strong contrast with an issue of floc formation; as with gelatin or coring formation, one has developed floc, as is known in the art. Therefore, one of ordinary skill in the art at the time of the instant invention would not have attempted the instant claims having available Eberhard and McGrow.

As Applicant respectfully traversed the Examiner's Rejections, Applicant respectfully requests allowance of claims 33, 35, 38 and 40 as presented herein.

Examiner Rejection

The proportions recited in claim 40 are suggested by McGrow or the result of routine experimentation because dose is a known result-effective variable in the sludge conditioning art.

Applicant response

Applicant appreciates effort of the Examiner to formulate his rejection.

In regard to instant dependent claim 40, McGrow does not teach "the concentration of said polymeric quaternary ammonium compound to the percentage of solids in said sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent", as claimed in instant dependent claim 40.

Applicant Response to Examiner Further Argument in Regard to Audrey Haase Declaration

In performing "hindsight reconstruction", as previously argued by Applicant, respectfully the Examiner misses the point. The point is, as respectfully argued again herein, that ALL citations at the time of the instant invention, INCLUDING MCGROW, teach use of a cationic polyacrylamide alone, UNLESS THERE IS AN ISSUE OF CORING OR OF GELATIN FORMATION. Therefore, as coring and/or gelatin formation occur AFTER FLOC FORMATION; and, the challenge with the dewatering of bio-solids from a thermophilic digestion process are associated with ABILITY TO FORM A FLOC, ***the two are at opposite ends of the spectrum***. Therefore, there is no reason for a rational person of ordinary skill in the art to have applied McGrow at the time of the instant invention. This is further, by COPYING BY OTHERS AFTER TEACHINGS OF THE INSTANT INVENTION, as argued herein again and evidenced in the application file history.

Applicant Reply to Examiner Further Response to Applicant's Arguments

If McGrow teaches use of a cationic polyacrylamide alone, then **he teaches use of a cationic polyacrylamide alone**. It is that simple. Therefore, if one of ordinary skill in the art had McGrow available and did not have coring or gelatin formation, one of ordinary skill in the art WOULD not use a two polymer system. As, **McGrow teaches away from a two polymer system without either coring or gelatin formation.**

Dentel and Chitikela support the teaching within McGrow of a single polymer system, **unless there is coring or gelatin formation; as, Dentel and Chitikela are silent in regard to coring and gelatin formation. Therefore, Dentel, Chitikela and McGrow are in agreement.**

Applicant respectfully presents that the Examiner cannot have it both ways. The Examiner cannot exclude the Praksaam EPA Project Summary of September 1990, stating that September 1990 is too old; and then, cite McGrow which has a publication date of May 1993; when, the instant application was filed September 1996, especially when, those in the art did not practice the instant invention at three locations, e.g. Texarkana, College Station and Los Angeles, prior to teachings of Applicant.

In regard to instant independent claim 33, Applicant respectfully presents that the instant specification teaching, while it does not eliminate an additional step or polymer, it also does no teach an additional step or polymer. Therefore, the Examiner in requiring and inserting an additional step or polymer while reading into the specification at col. 5 lines 2 to 4, which states:

> The significant improvements of this invention in sludge dewatering are accomplished by the addition of polyquaternary amines to the sludge.

Claim Allowance

Applicant respectfully requests allowance of claims 1-8, 10-16, 22, 24-28, 33, 35-38, 40, 41, 44-48, 51-55, 58, 67-70, and 73 as presented herein.

Conclusion

Applicant respectfully requests entry of this Office Action Response, along with favorable reconsideration of the pending claims. Applicant has respectfully provided to the Examiner facts and argument which support allowance of the instant claims. Specifically, Applicant has respectfully provided to the Examiner relevant facts and argument relating to: teaching away by notable published references at the time of the instant invention; teaching away of cited references; lack of teaching by cited references, Applicant discovery of the source of the problem not taught in any reference or citation, as evidenced in the instant application and required by notable published references at the time of the instant application; hindsight reconstruction required for the Examiner's Citations both at face value and when taken in context with notable publications at the time of the instant application; and, copying by others after Applicant's teachings, as evidenced in secondary considerations. Applicant has also presented that many of the Examiner's Citations are for a different application, purpose or problem, than the instant claims.

This response places the claims in a condition for allowance. Applicant requests that in view of this fact, this Office Action response be entered, and after due consideration of the respectful presentation herein, the claims be allowed and a certificate be issued.

This is an old file; while, Applicant has again provided the Examiner numerous reasons of patentability for the instant claims. Therefore, in order to avoid appeal to the Board of Patent Appeals and Interferences and potentially to the Federal Court of Appeals for the Federal Circuit, as well as facilitate resolution of any issues or questions, Applicant respectfully requests that the Examiner directly contact the undersigned by phone to further discussion, reconsideration and allowance of the instant claims.

Respectfully submitted,

Date: February 13, 2012

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